CLAIMS

The invention claimed is:

1. A crucible comprising:

a wall including a bottom wall and side wall;

an aluminum-doped layer formed on an inner portion of said wall; and

an aluminum-doped layer formed on an outer portion of said wall.

2. The crucible of claim 1, wherein the aluminum-doped outer layer is substantially an outer layer of the side wall.

3. The crucible of claim 1, wherein the inner layer is in the range of 0.2–1.2mm deep.

4. The crucible of claim 1, wherein the inner layer is doped with aluminum in the range of about 50–500ppm.

5. The crucible of claim 1, wherein the outer layer is no more than substantially 0.5–2.5 mm deep.

6. The crucible of claim 1, wherein the outer layer is doped with aluminum in the range of about 100–500ppm.

7. The crucible of claim 1, wherein a portion of the side wall interposed between the outer layer and the inner layer is free of aluminum doping.

8. The crucible of claim 1, wherein a portion of the bottom wall interposed between the outer layer and the inner layer is free of aluminum doping.

9. A method for making a silica glass crucible, comprising:

introducing into a rotating crucible mold outer silica grain doped with aluminum to form an outer layer;

introducing into said mold bulk silica grain consisting essentially of quartz grain to form a bulky wall including a bottom wall and a side wall;

heating the interior of the mold; and

introducing into said mold inner silica grain doped with aluminum, wherein the heat fuses said outer and bulk silica grains and at least partially melts said inner silica grain and fuses said at least partially molten inner silica grain to the bulk wall to form an inner layer.

10. The method of claim 9, further comprising cooling the fused silica grains so as to form within the inner layer a plurality of nuclei of crystalline silica.

11. The method of claim 10, wherein cooling comprises maintaining the crucible in the range of 400-600°C for approximately 25 minute.

12. The method of claim 10, wherein cooling comprises maintaining the crucible in the range of 1400-1600°C for approximately one minute.

13. The method of claim 9, wherein the outer layer is formed substantially on the side wall.

14. The method of claim 9, wherein a selected thickness of the inner layer is in the range of 0.2–1.2mm.

15. The method of claim 9, wherein the inner silica grain is doped with aluminum in the range of 50–500ppm.

16. The method of claim 9, wherein the outer silica grain is doped with aluminum in the range of 100–500ppm.

17. A silica glass crucible, comprising:

a wall including a bottom wall and a side wall;

an homogeneously aluminum-doped layer formed on the inner portion of said wall;

wherein said layer has a depth in the range of 0.2–0.5mm and is doped with aluminum in the range of about 50–500ppm.

18. The crucible of claim 17, wherein the inner layer is doped with aluminum in the range of about 80–160ppm.

19. The crucible of claim 17, wherein the inner layer is doped with aluminum in the range of about 100–120ppm.

20. A method for making a silica glass crucible, comprising:

introducing into a rotating crucible mold bulk silica grain consisting essentially of pure silica grain to form a bulk grain wall having a bottom wall and a side wall;

heating the interior of the mold;

introducing into said mold inner silica grain doped with aluminum, wherein the heat fuses said bulk silica grain and at least partially melts said inner silica grain and fuses said at least partially molten inner silica grain to the bulk grain wall to form a homogeneously aluminum-doped inner layer.

21. The method of claim 20, further comprising cooling so as to form within the inner layer a plurality of nuclei of crystalline silica.

22. The method of claim 21, wherein cooling comprises maintaining the crucible in the range of 400-600°C for approximately 25 minute.

23. The method of claim 21, wherein cooling comprises maintaining the crucible in the range of 1400-1600°C for approximately one minute.

24. The method of claim 20, wherein a selected thickness of the inner layer is in the range of 0.2–0.5mm.

25. The method of claim 20, wherein the inner silica grain is doped with aluminum in the range of 50–500ppm.

26. The crucible of claim 20, wherein the inner layer is doped with aluminum in the range of about 80–160ppm.

27. The crucible of claim 20, wherein the inner layer is doped with aluminum in the range of about 100–120ppm.

28. A silica glass crucible comprising:

a wall including a bottom wall and a side wall; and

a layer non-homogeneously doped with aluminum formed on an inner portion of said wall to promote crystallization of silica.

29. The crucible of claim 28, wherein the inner layer has an average aluminum doping of 30–100ppm and a depth in the range of greater than 0.2mm to 1.5mm.

30. The crucible of claim 28, wherein the inner layer has a thickness of substantially 0.3–0.7mm.

31. A method for making a silica glass crucible, comprising:

introducing into a rotating crucible mold bulk silica grain to form a bulk grain wall having a bottom wall and a side wall, said bulk silica grain consisting essentially of pure silica grain;

heating the interior of the mold;

introducing into said mold a non-homogeneous combination of silica grain containing aluminum, wherein the heat fuses said bulk silica grain and wherein the heat at least partially melts said non-homogeneous silica grain and fuses said at least partially molten non-homogeneous silica grain to the wall to form an inner layer.

32. The method of claim 31, further comprising cooling so as to form within the inner layer a plurality of nuclei of crystalline silica.

33. The method of claim 32, wherein cooling comprises maintaining the crucible in the range of 400-600°C for approximately 25 minute.

34. The method of claim 32, wherein cooling comprises maintaining the crucible in the range of 1400-1600°C for approximately one minute.

35. The method of claim 31, wherein the non-homogeneous combination of silica grain containing aluminum is comprised of a mixture of aluminum-doped silica grain and non-doped silica grain.

36. The method of claim 35, wherein the aluminum-doped silica grain is doped with at least 80ppm to approximately 160ppm aluminum.

37. The method of claim 35, wherein the aluminum-doped silica grain is doped with approximately 90ppm to 110ppm aluminum.

38. The method of claim 35, wherein the non-doped silica grain is natural quartz grain containing less than approximately 18ppm aluminum.

39. The method of claim 35, wherein the non-doped silica grain is synthetic silica grain containing less than approximately 1ppm aluminum and less than approximately 5ppm of total metallic impurities.

40. The method of claim 31, wherein the non-homogeneous combination of silica grain containing aluminum is coarse quartz grain coated with aluminum and wherein at least approximately 20% of the coarse quartz grains are larger than approximately 200um in grain size.

41. The crucible of claim 40, wherein at least approximately 50% of the coarse quartz grains are larger than approximately 200um in grain size.

42. The method of claim 31, wherein the inner layer has a thickness of substantially 0.2–1.5mm.

43. The method of claim 31, wherein the inner layer has a thickness of substantially 0.3–0.7mm.

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